

ORIGINAL RESEARCH

## Analysis of Vascularized Bone Flap for Thoracic Spinal Reconstruction: An Institutional Based Study

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**Abstract:**

**Background:** Reconstruction of bony defects can be a challenging endeavor. Goals of surgical management include adequate debridement, reconstitution of structural integrity, and delivery of antibiotics to the area of interest. The present study was conducted to evaluate the outcomes of free vascularized fibula flaps and pedicled rib flaps used for thoracic spinal reconstruction.

**Materials and Methods:** The present study was conducted evaluate the outcomes of free vascularized fibula flaps and pedicled rib flaps used for thoracic spinal reconstruction. This study reviewed 18 vascularized bone flaps. The follow-up data was obtained. Statistical analysis was conducted using statistical package for the social sciences (SPSS, version 20; SPSS Inc., Chicago, Illinois, USA) on an IBM compatible computer.

**Results:** In the present study union rate was 92 percent. The mean time to union taken by free vascularized fibula flaps was  $9 \pm 2$  months; anterior pedicled rib flaps,  $9 \pm 5$  months; and posterior pedicled rib flaps,  $9 \pm 3$  months ( $p = 0.92$ ). Less time was taken by free vascularized fibula flaps.

**Conclusion:** The present study concluded that free vascularized fibula flaps were better than pedicled rib flaps for thoracic spinal reconstruction as union was faster.

**Keywords:** Free Vascularized Fibula Flaps, Pedicled Rib Flaps, Thoracic Spinal Reconstruction.

### INTRODUCTION

The use of free vascularised bone grafts (FVBGs) was introduced by Taylor in 1975<sup>1</sup>, and is currently a well-accepted and frequently used surgical technique in the reconstruction of large

skeletal defects.<sup>2,3</sup> Free or pediculated flap procedures are well known to reconstructive surgeons. One such, used for spinal bone defect filling, is the free vascularized fibula flap.<sup>4-6</sup> Numerous studies have demonstrated the superiority that VBGs provide biologically and mechanically over N-VBGs, and these attributes contribute to greater fusion rates, reduced failure rates, and greater mechanical stability during the critical postoperative period in patients with complex pathologies.<sup>7-11</sup> In spinal surgery, FVBG are used for the reconstruction of complex primary or secondary defects and/or loss of structural integrity of one or more spinal segments that require adequate, long-term, mechanical stability. The indications include progressive symptomatic spinal deformities, trauma, (chronic) infections and vertebral corpectomies for primary or metastatic spinal tumours.<sup>12-14</sup> Pedicled rib VBGs were popularized by Bradford in the treatment of kyphosis, utilizing an anterior approach.<sup>15</sup> Since then, multiple studies have reported the success of pedicled rib VBG in thoracic spinal reconstruction, including studies by Wilden et al and Lewis et al.<sup>16-18</sup> The present study was conducted to evaluate the outcomes of free vascularized fibula flaps and pedicled rib flaps used for thoracic spinal reconstruction.

## MATERIALS AND METHODS

The present study was conducted evaluate the outcomes of free vascularized fibula flaps and pedicled rib flaps used for thoracic spinal reconstruction. Before the commencement of the study ethical approval was taken from the Ethical committee of the institute and informed consent was obtained from all patients included in the study. This study reviewed 18 vascularized bone flaps i.e. 3 anterior pedicled rib flaps, 10 posterior pedicled rib flaps, and 5 vascularized fibula flaps for corpectomy defects spanning T1 to L1. Patients with corpectomy defects spanning T1 to L1 and in the age group 45-75 yrs were included. Surgical procedures included anterior, anterolateral, lateral or posterior spinal approaches. The reconstructive surgeon participates in the spinal approach to the extent that the recipient vessels are selected and dissected as early in the operation as possible. The follow-up data was obtained. Statistical analysis was conducted using statistical package for the social sciences (SPSS, version 20; SPSS Inc., Chicago, Illinois, USA) on an IBM compatible computer.

## RESULTS

In the present study, the union rate was 92 percent. The mean time to union taken by free vascularized fibula flaps was  $9 \pm 2$  months; anterior pedicled rib flaps,  $9 \pm 5$  months; and posterior pedicled rib flaps,  $9 \pm 3$  months ( $p = 0.92$ ). Less time was taken by free vascularized fibula flaps.

**Table 1: Union Time among three groups**

Groups	Mean time for Union	P value
<b>Anterior pedicled rib flaps</b>	$9 \pm 5$ months	0.92
<b>Posterior pedicled rib flaps</b>	$9 \pm 3$ months	
<b>Free vascularized fibula flaps</b>	$9 \pm 2$ months	

## DISCUSSION

Vascularized fibula transplant techniques are part of the therapeutic arsenal of reconstructive surgeons.<sup>19,20</sup> They are indicated for bone defects from 5 to 25 cm. The size of the pedicle is 1.8

to 2.5 mm for the artery and 2 to 4 mm for the vein, with a length of 4 cm, or more, at the cost of longer bone transplant. The graft may be osteomyocutaneous or osteocutaneous. There are 2 to 5 skin perforator arteries, distributed on a 16 × 6 cm pad.<sup>21</sup>

In the present study, the union rate was 92 percent. The mean time to union taken by free vascularized fibula flaps was 9 ± 2 months; anterior pedicled rib flaps, 9 ± 5 months; and posterior pedicled rib flaps, 9 ± 3 months (p = 0.92). Less time was taken by free vascularized fibula flaps.

Winters H et al reported their experience with free vascularised bone grafts, with special emphasis on the surgical approach and the selection of recipient vessels. Over a period of 17 years (1994–2011), they used these grafts for anterior spinal reconstruction in 30 patients. In 28 patients, a free vascularised fibular graft was used, and in two cases a free vascularised iliac crest graft was used. The spinal segments reconstructed involved the cervical or cervicothoracic spine (6 cases), the thoracic spine (11 cases) and the thoracolumbar and lumbosacral spine (13 cases). Revascularisation of the free vascularised bone graft proved to be technically feasible in 30 patients but failed in one fibular graft due to difficulties with recipient vessels in the lumbar region. Technical challenges were met with respect to the choice of the recipient vessel at various anatomical sites. Availability of acceptor vessels was highly dependent of the type of surgery (resection or stabilisation) and the selected surgical approach. Based on these findings, a preferred approach is given for each region. The use of free vascularised bone grafts is a valuable technique for the reconstruction of complex spinal disorders.<sup>22</sup>

Wilden J A et al determine the results, including the time to osseous union and complications, following anterior or posterior placement of pedicled vascularized rib grafts for complex spinal reconstruction. The preoperative diagnoses included metastatic or primary tumor (thirteen patients) and progressive kyphosis secondary to chronic osteomyelitis (two), injury (one), congenital anomalies (one), or implant failure (one). On the average, 4.4 levels were fused and 1.9 vertebral bodies were excised. All eighteen arthrodeses included various forms of allograft and/or autograft material, and instrumentation was used, in addition to the vascularized rib graft, in twelve patients. The mean rib length was 16.1 cm, and a rib between the fifth and eleventh ribs, inclusive, was used, depending on the location of the spinal reconstruction. The average time to union was 6.8 months, and all rib grafts united. There were no complications specific to the rib-harvesting procedure.<sup>23</sup>

Asaad M et al found that free vascularized fibula flaps and pedicled rib flaps provide durable reconstruction for thoracic spinal defects. Union, time to union, revision, and reoperation rates were similar among anterior and posterior pedicled rib flaps and vascularized fibula flaps.<sup>24</sup>

## CONCLUSION

The present study concluded that free vascularized fibula flaps were better than pedicled rib flaps for thoracic spinal reconstruction as union was faster.

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